

REMARKS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-18 are currently pending. Claims 1-18 have been amended by the present amendment. The changes to the claims are supported by the originally filed specification and do no add new matter.

In the outstanding Office Action, Claims 2, 4, and 6 were objected to regarding various informalities; Claims 1, 2, and 7 were rejected under 35 U.S.C. § 103(a) as being unpatentable over “the admitted prior art in Figure 10” (hereinafter “the Background Art”) in view of U.S. Patent No. 5,706,313 to Blasiak et al. (hereinafter “the ‘313 patent”), U.S. Patent No. 5,996,104 to Herzberg (hereinafter “the ‘104 patent”) and U.S. Patent No. 6,301,684 to Watanabe et al. (hereinafter “the ‘684 patent”); Claims 3-6, 9, and 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the Background Art, the ‘313 patent, the ‘104 patent, and the ‘684 patent, further in view of U.S. Patent No. 6,269,124 to Nagayasu et al. (hereinafter “the ‘124 patent”); Claims 8, 13, and 14 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,574,283 to Sakoda et al. (hereinafter “the ‘283 patent”) in view of the Background Art, the ‘313 patent, the ‘104 patent and the ‘684 patent; and Claims 10, 12, and 15-18 were rejected under 35 U.S.C. §103(a) as being unpatentable over the ‘283 patent in view of the Background Art, the ‘313 patent, the ‘104 patent, the ‘684 patent, and the ‘124 patent.

Applicants respectfully submit that the objections to the claims are rendered moot by the present amendment to Claims 2, 4, and 6. Claim 2 has been amended to correct the informality regarding the word “data,” while Claims 2, 4, and 6 have been amended to insert the word “the” before the words “hard decision data”. Accordingly, the objections to the claims are believed to have been overcome.

Amended Claim 1 is directed to a demodulator, comprising: (1) a multiple differential phase detected signal output unit configured to calculate phase differences between a received signal and previously received signals of 1, 2,..., N symbols (where N is an integer greater than 2) so as to output 1, 2,..., N symbol differential phase detected signals; and (2) a soft decision demodulated data estimating unit configured to estimate a transmitted differential phase sequence according to the 1, 2,..., N symbol differential phase detected signals using a trellis diagram representing transitions of differential phase states of transmitted signals and a Viterbi algorithm, and to estimate soft decision demodulated data according to the estimated transmitted differential phase sequence and a survival path metric that transits into each state on the trellis diagram. Further, Claim 1 recites that the soft decision demodulated data are estimated as the product of hard decision data and reliability information. Claim 1 has been amended to clarify that the reliability information is calculated by subtracting a likelihood for a first survival path metric corresponding to a first survival path that transits into a first state on the trellis diagram from a likelihood for a second survival path metric corresponding to a second survival path that transits into a second state on the trellis diagram, wherein the first state is different from the second state. The changes to Claim 1 are supported by the originally filed specification and do not add new matter.¹

Applicants respectfully submit that the rejection of Claim 1 under 35 U.S.C. § 103(a) is rendered moot by the present amendment to Claim 1.

Regarding the rejection of Claim 1, the Office Action asserts that the Background Art discloses everything in Claim 1 with the exception of the soft decision demodulated data estimating unit configured to estimate the soft decision demodulated data as a product of hard

¹ See, e.g., pages 32-35 of the specification.

decision data and reliability information, and relies on the '313, '104, and '684 patents to remedy that deficiency.

The Background Art is directed to is directed to a multiple differential phase detector 500, as shown in Figure 10. However, as admitted in the Office Action, the Background Art fails to disclose the soft decision demodulated data estimating unit recited in Claim 1.

The '313 patent is directed to a soft decision digital communications method and apparatus for decoding a coherent differentially encoded multilevel phase-shift keyed (DEPSK) modulated signal. However, as admitted in the Office Action, the '313 patent fails to disclose that the soft decision demodulated data are estimated as a product of hard decision data and reliability information, as recited in Claim 1.

The '104 patent is directed to a method and apparatus for coding an information signal. However, as admitted in the Office Action, the '104 patent fails to disclose that the soft decision demodulated data are estimated as the product of hard decision data and reliability information, wherein the reliability information is calculated by subtracting a likelihood for a first survival path metric having a first state on the trellis diagram from the likelihood for a second survival path metric having a second state on the trellis diagram. Thus, the Office Action asserts that the '684 patent discloses the reliability information recited in Claim 1.

The '684 patent is directed to a data decoding apparatus and method for decoding convolution coded input data. In particular, the '684 patent discloses an equalizer 25 that converts IQ data into convolution coded data by using the Viterbi algorithm. Moreover, the '684 patent discloses that the equalizer 25 also produces reliability data CF representing the reliability of the convolution coded data "y" by using a calculation result obtained by applying the Viterbi algorithm. As shown in Figure 4, the '684 patent discloses that the reliability data CF is computed as the difference between two values: (1) the sum of a state

metric of a state “x” and the branch metric for the transition from the state “x” to the next state NS; and (2) the sum of the state metric of the state “y” plus the branch metric from the state “y” to the next state NS. Thus, the ‘684 patent discloses that the reliability data is calculated as the difference between two path metrics corresponding to two different paths that transition into a given next state NS. However, Applicants respectfully submit that the ‘684 patent fails to disclose reliability information that is calculated by subtracting a likelihood for a first survival path metric corresponding to a first survival path that transits into a first state on the trellis diagram from a likelihood for a second survival path metric corresponding to a second survival path that transits into a second state on the trellis diagram, wherein the first state is different from the second state, as recited in amended Claim 1. Rather, the ‘684 patent discloses that the reliability data CF is calculated as a difference between two path metrics corresponding to two paths that transit into the same next state. The ‘684 patent discloses calculation of reliability data by obtaining the absolute value of the difference between state metrics PS, which represent the likelihood of transition to each state.²

Accordingly, Applicants respectfully submit that no matter how the teachings of the Background Art, the ‘313 patent, the ‘104 patent, and the ‘684 patent are combined, the combination does not teach or suggest the reliability information recited in amended Claim 1. Accordingly, Applicants respectfully submit that amended Claim 1 (and dependent Claim 2) patentably define over any proper combination of the Background Art, the ‘313 patent, the ‘104 patent, and the ‘684 patent.

Claim 7 recites limitations analogous to the limitations recited in Claim 1. Moreover, Claim 7 has been amended in a manner analogous to the amendment to Claim 1. Accordingly, for the reasons stated above for the patentability of Claim 1, Applicants

² See ‘684 patent, column 7, lines 38-50, and column 7, line 66 to column 8, line 4.

respectfully submit that the rejection of Claim 7 is rendered moot by the present amendment to that claim.

Applicants respectfully submit that the rejections of independent Claims 3, 5, 9, and 11 are rendered moot by the present amendment to those claims. Claims 3, 5, 9, and 11 have been amended to recite limitations analogous to the limitations recited in Claim 1. In particular, each of amended Claims 3, 5, 9, and 11 recite that the reliability information is calculated by subtracting a likelihood for a first survival path metric corresponding to a first survival path that transits into a first data on the trellis diagram from a likelihood for a second survival path metric corresponding to a second survival path that transits into a second state on the trellis diagram, wherein the first state is different from the second state. However, as discussed above, the Background Art, the '313, the '104 patent, and the '684 patent each fail to disclose that the reliability information is calculated by subtracting a likelihood for a first survival path metric corresponding to a first survival path that transits into a first state on the trellis diagram from a likelihood for a second survival path metric corresponding to a second survival path that transits into a second state on the trellis diagram, wherein the first state is different from the second state.

The '124 patent is directed to a data transmission system, receiver, and recording medium in which a soft decision circuit outputs soft decision data so as to decrease the number of different bits between the pseudo transmission signals and the received signals and the received data are generated based on the soft decision data. However, Applicants respectfully submit that the '124 patent fails to cure the deficiencies of the Background Art, the '313 patent, the '104 patent, and the '684 patent, as discussed above. In particular, the '124 patent fails to disclose that the reliability information is calculated by subtracting a likelihood for a first survival path metric corresponding to a first survival path that transits into a first state on the trellis diagram from a likelihood for a second survival path metric

corresponding to a second survival path that transits into a second state on the trellis diagram, wherein the first state is different from the second state, as recited in independent Claims 3, 5, 9, and 11. Accordingly, Applicants respectfully submit that Claims 3, 5, 9, and 11 (and all associated dependent claims) patentably define over any proper combination of the Background Art, the '313 patent, the '104 patent, the 684 patent, and the '124 patent.

Applicants respectfully submit that the rejections of Claims 8, 10, and 12-18 under 35 U.S.C. § 103(a) are rendered moot by the present amendment to those claims. Claims 8, 10, and 12-18 recite limitations analogous to the limitations recited in Claim 1. In particular, Claims 8, 10, and 12-18 recite that the reliability information as calculated by subtracting the likelihood for a first survival path metric corresponding to a first survival path that transits into a first state on the trellis diagram from a likelihood for a second survival path metric corresponding to a second survival path that transits into a second state on the trellis diagram, wherein the first state is different from the second state. However, as discussed above, the Background Art, the '313 patent, the '684 patent, the '124 patent, and the '104 patent each fail to disclose that the reliability information is calculated as recited in amended Claims 8, 10, and 12-18.

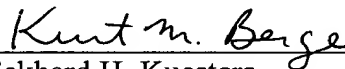
Further, Applicants respectfully submit that the '283 patent also fails to disclose that the reliability information is calculated by subtracting a likelihood for a first survival path metric corresponding to a first survival path that transits into a first state on the trellis diagram from a likelihood for a second survival path metric corresponding to a second survival path that transits into a second state on the trellis diagram, as recited in amended Claims 8, 10, and 12-18. Accordingly, Applicants respectfully submit that amended Claims 8, 10, and 12-18 patentably define over any proper combination of the '283 patent, the '313 patent, the '104 patent, the '684 patent, the '124 patent, and the Background Art.

Thus, it is respectfully submitted that independent Claims 1, 3, 5, and 7-18 (and all associated dependent claims) patentably define over any proper combination of the Background Art, and the '313, '104, '124, '684, and '283 patents.

Consequently, in view of the present amendment and in light of the above discussion, the outstanding grounds for rejection are believed to have been overcome. The application as amended herewith is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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